IEEE P802.11  
Wireless LANs

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| ARC SC teleconference Minutes 16 Sept 2018 - Interim | | | | |
| Date: 2020-09-16 | | | | |
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Abstract

This document contains the minutes of the IEEE 802.11 ARC SC teleconference held on 16 September 2020 at 11:15-13:15 h ET, during the 802.11 Interim meeting week.

Note: Highlighted text are action items. C- proceeds comments, R- proceeds responses to comments

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# Wednesday 16 September 2020, 11:15-13:15 h EDT

**Administration:**

**Chair: Mark Hamilton, Ruckus/CommScope**

**Vice Chair: Joseph Levy, InterDigital**

**Secretary: Joseph Levy, InterDigital**

**Meeting called to order by the Chair 11:17 EDT,**

Agenda slide deck: [11-20/1343r4](https://mentor.ieee.org/802.11/dcn/20/11-20-1343-04-0arc-arc-sc-agenda-16-sep-2020.pptx) proposed agenda copied here for reference (will be r5 out of the meeting):

**Administration:**

The Chair reviewed the Administrative information in the agenda document, [11-20/1343r4](https://mentor.ieee.org/802.11/dcn/20/11-20-1343-04-0arc-arc-sc-agenda-16-sep-2020.pptx)

**Call for Patents:**

The Chair reviewed the Patent policy and called for potentially essential patents – there was no response to the call.

**Participation:**

The chair reviewed the participation policy

**Approval of the Agenda:**

* **Attendance, noises/recording, meeting protocol reminders**
* **Policies, duty to inform, participation rules**
* **Chair/Vice Chair/Secretary positions**
* **Prior meeting minutes**
* **Note – updates to 11-20/0177 (now r3)**
* **Contributions:**
  1. **802.11 TGbe’s evolving multi-link architecture contributions:**
  2. [**https://mentor.ieee.org/802.11/dcn/20/11-20-1240-00-00be-how-many-macs-and-spacetime-in-reference-models.pptx**](https://mentor.ieee.org/802.11/dcn/20/11-20-1240-00-00be-how-many-macs-and-spacetime-in-reference-models.pptx) **- Mark Hamilton**
  3. [**https://mentor.ieee.org/802.11/dcn/20/11-20-1200-00-00be-11be-architecture-discussion.pptx**](https://mentor.ieee.org/802.11/dcn/20/11-20-1200-00-00be-11be-architecture-discussion.pptx) **- Mark Hamilton**
* **Next steps**

The Chair reviewed the agenda and called for comments or amendments to the agenda - there was no response to the call.

The proposed agenda was approved by unanimous consent.

**Chair/Vice Chair/Secretary positions:**

Chair – support for re-affirmation

* + Mark Hamilton (Ruckus/CommScope)

Vice Chair and Secretary – re-affirmation & motion

* + Joseph Levy (InterDigital)

MOTION-1: ARC SC supports Mark Hamilton (Ruckus/CommScope) as Chair and re-affirms Joseph Levy (InterDigital) as Vice Chair (respectively) for the period 2020-2022 (to be aligned with Working Group election cycle in 2022).

Moved: Graham Smith, Second: Jon Rosdahl - unanimous consent

MOTION-2: ARC SC approves Joseph Levy (InterDigital) as Secretary for the period 2020-2022 (to be aligned with Working Group election cycle in 2022).

Moved: Graham Smith, Second: Jon Rosdahl - unanimous consent

**Prior meetings minutes:**

January F2F

* [**https://mentor.ieee.org/802.11/dcn/20/11-20-0144-00-0arc-arc-sc-meeting-minutes-january-2020.docx**](https://mentor.ieee.org/802.11/dcn/20/11-20-0144-00-0arc-arc-sc-meeting-minutes-january-2020.docx)

August 6 telecon

* [**https://mentor.ieee.org/802.11/dcn/20/11-20-1193-00-0arc-arc-sc-teleconference-minutes-06-august-202018.docx**](https://mentor.ieee.org/802.11/dcn/20/11-20-1193-00-0arc-arc-sc-teleconference-minutes-06-august-202018.docx)

August 24 telecon

* [**https://mentor.ieee.org/802.11/dcn/20/11-20-1283-00-0arc-arc-sc-teleconference-minutes-24-august-202018.docx**](https://mentor.ieee.org/802.11/dcn/20/11-20-1283-00-0arc-arc-sc-teleconference-minutes-24-august-202018.docx)

All the above minutes are approved by unanimous consent.

**Note – updates to 11-20/0177:** [**11-20/0177r4**](https://mentor.ieee.org/802.11/dcn/20/11-20-0177-04-0arc-liaison-to-revmd-on-ess.docx)

The Chair reviewed history of this liaison document, including an explanation for the delay of this document being discussing in TGmd. The document was discussed in TGmd, and changes were made to the original document.

C – Thank you for driving this, this tidying up of this is important. We are concerned about these definitions as both WBA and WFA both use these definitions. Should we LS with these groups about these changes?

Chair – that should be considered.

C – Should we approve this document?

Chair – that would be up to the group.

Chair – reviewed the status in TGmd, there have been comments both pro and con in TGmd.

C – This should be address in TGmd – but I do not think this should be discussed further now.

C – We should just focus on what we are proposing.

C – While I support this work – I do not think a large portion of the group have knowledge on this topic. It would probably be better to ask people to go to TGmd.

Chair – called for support in TGmd for 11-20/177r4.

**Contributions:**

* **802.11 TGbe’s evolving multi-link architecture contributions:**

[**https://mentor.ieee.org/802.11/dcn/20/11-20-1240-00-00be-how-many-macs-and-spacetime-in-reference-models.pptx**](https://mentor.ieee.org/802.11/dcn/20/11-20-1240-00-00be-how-many-macs-and-spacetime-in-reference-models.pptx) **- Mark Hamilton**

[**https://mentor.ieee.org/802.11/dcn/20/11-20-1200-00-00be-11be-architecture-discussion.pptx**](https://mentor.ieee.org/802.11/dcn/20/11-20-1200-00-00be-11be-architecture-discussion.pptx) **- Mark Hamilton**

Previous multi-link architecture contributions, discussed on prior ARC SC teleconference:

* <https://mentor.ieee.org/802.11/dcn/20/11-20-1148-00-00be-discussion-on-mld-architecture.pptx> - Po-Kai Huang
* <https://mentor.ieee.org/802.11/dcn/20/11-20-1131-01-00be-multi-link-reference-model-discussion.pptx> - Yonggang Fang
* <https://mentor.ieee.org/802.11/dcn/20/11-20-1171-01-00be-multi-link-ap-network-reference-model-discussion.pptx> - Yonggang Fang
* <https://mentor.ieee.org/802.11/dcn/20/11-20-1122-01-00be-802-11be-architecture-association-discussion.pptx> - Joseph Levy

[**https://mentor.ieee.org/802.11/dcn/20/11-20-1240-00-00be-how-many-macs-and-spacetime-in-reference-models.pptx**](https://mentor.ieee.org/802.11/dcn/20/11-20-1240-00-00be-how-many-macs-and-spacetime-in-reference-models.pptx) **- Mark Hamilton**

Mark Hamilton presented, reacting to comments on document 11-20/1200, this document provides a top-level overview (context for 11-20/1200).

C – There is no timing in the MAC – there is no method in the spec that says how long things take.

C – There is a concept of sequencing. Even Beacons do not necessary happen at a specific time.

R – Things at the PHY level have timing – but only for things that are visible in the specification. E.g. how long it takes to process a frame is not specified – what the sequence response is, is specified.

C – Since we are having this discussion in 11be – there are a lot of time sensitive actions. 11be may generate new requirement regarding timing.

C – Synchronization may require considering speed of light – which may make thing very complex – we should strive to avoid this if we can.

Mark continued the presentation on slide 6,7, 8, 9,

C – There is no change in TGbe regarding the PN. I think everything is the same.

R – I am not sure that that is true – this is an introduction and describing that the MAC generally does not have time/space requirements, unless it is specifically necessary. We should keep the specification as simple as we can, and not introduce parallelism if we can avoid it.

C – If there is over the air behavior that breaks interoperability, then the standard is broken – if it is time related it need to be address in the standard.

C – If there is a functionality – that the specification requires it needs to be included, but if it is implementation it does not need to be defined. The spec needs to detail observable behavior.

R – if it is observable and required for interoperability it should be included, otherwise not.

C – Legacy stations need to be supported – people want to add how legacy stations are supported in the specification.

C – In 802.11ay – we set up round trip time limits – the time intervals in currently in 802.11ax could have timing issues – we may need to address this. We are considering propagation delay in some cases.

[**https://mentor.ieee.org/802.11/dcn/20/11-20-1200-00-00be-11be-architecture-discussion.pptx**](https://mentor.ieee.org/802.11/dcn/20/11-20-1200-00-00be-11be-architecture-discussion.pptx) **- Mark Hamilton**

Presented by Mark Hamilton

Slide 1,2,3

Describing 802.11ad FST – overview diagram – FST entity is a thin shin.

C – When we look at this model into .11be world – we see the possible need to integrate the two MACs to provide the desired capabilities. So, the question is do want to keep the STA concept, or introduce a new concept or break apart the STA concept.

R – In FST the STA do operate as separate entities. But for 11.be we are crossing a line – with functionality.

C – Agree if you just look a MLD – if there are only two, it makes sense – but you just don’t design an AP to just work for MLD, you have legacy and MLD – you have beacon, so we need to support both – MLD has this integration. When you look at beacon transmission. If you look purely at MLD it seems to be missing legacy.

C – The specification is defining logical devices, not implementations. An implementation may consist of and act like multiple logical devices. The specification should not address implementation.

C – In the physical world – you can have logical devices, e.g. a guest network, a personal network. But for MLD some functionality needs to be kept. When we are talking about logical devices, we need consider this. I do not think we are saying anything about physical. Legacy support is very important – we are not designing from scratch.

C – A logical device is not a guest network or a personal network, a logical device has known behaviors and can be specified. The specification should not specify how multiple logical devices can be simultaneously implemented in a device.

C – I am in line with the above statement – we do not want to require how things need to instantiate things. The ARC is evolving – we need to keep this to be a single entity that can evolve – I think we need to evolve the basic elements as we have them and evolve them over time.

R – It needs to be agreed as to where/how to specify what is done to ensure the remote peer can function.

On slide 5/6 –

C – In this view the MAC-L and MAC-U – then MAC-U is MLD, but how does legacy work with this?

R – lets differ this to later, during the MLD discussion

C – I think we should limit the MAC-U to a shim/switch on top of the existing MACs. Inverse multiplexer.

R – This gets very complex as coordination within the MAC becomes complex – as there is actually functionality in the MAC-U, so it is not a shim or switch.

C – MLD has only one SME – does the MLME has a single MAC address as in the diagram.

R – Let’s build an ARC diagram first and then decide how many MAC addresses we have.

C – I do not see how this could support multiple MAC addresses.

R – Today we have 1 PHY, 1 MAC, 1 MLME and 1 SME - but as we define this figure for MLO we need to make these decisions.

C – If we include legacy on top of the new it gets very complex – when it is a legacy – the legacy reference model would be followed. When MLO the MLO model would be followed. In MLO, may functional blocks move up to the “MAC-U” – so if you try to fit this into legacy model it will be difficult. Each beacon is a legacy beacon on each link – if we treat MLO separately it would be much simpler and clean.

R – I am trying to talk about MLO now and will talk about legacy later.

C – There are components of the legacy that has PHY dependent MAC portions and MAC independent portions.

C – 802.11 is not primary in any of these bands – we have had radar requirement in some bands – we have some channels that are time bound and others that are not. MLO must consider time requirements in the frequency bands that are will be used.

R – I would assume that the MAC-L would deal with the PHY specific requirements.

C – It is good to separate things out into MAC-L and MAC-U – maybe we can keep the current figure on slide 3 showing the upper a lower MAC – it would be best to keep things as simple as possible. And I would like to keep legacy separate.

R – Discussion on how to show architecture is the goal of this presentation- but regarding this slide 3 diagram: it only shows 2 PHYs, which doesn’t seem adequate – also the SME needs to span the whole MLO – coordination across the MLO may be very complex if we use this diagram.

C – Each link has an SME – but SME management coordinates the SMEs.

R – This figure is not drawn that way it is showing a single SME – so we need to consider how many SMEs we have.

C – If we rename the FST entity MAC-U I think we have everything we need. I think your drawing is very clear on 6, but I think we could make do with less – avoiding the perception that we are making major changes to the 802.11 architecture.

R – Agree we should try to keep things simple, but we also need to be clear.

C – One of the functions of ARC is to align with 802.1 – I do not see aggregation in 802.1 layer is what should be followed. If we call it link aggregation sublayer it would work.

R – I do not want to confuse what we are doing here with what 802.1 is doing in their aggregation.

C – I think we should deal with what aggregation/management is need and agree to specify that.

C – Going back to slide 3 – there is interest in recycling this figure for MLO – FST is very clear in architecture – we have multiple STAs in FST. This was a new architecture of FST. To go forward using this figure – is a short cut. MLO is making changes to the 802.11 architecture and we should not be shy about the changes we are making. This figure does not show BSSs. This figure has two distinct STAs and each is a BSS, even though it is not show. I think we should design a clear figure based on the architecture of MLO.

C – For me to understand – having multiple STAs on multiple PHYs – what does MAC/PHY-1 need to know about MAC/PHY-2 so that this entity can function. Why can’t I use multiple links, even across technologies?

R – What you are describing is basically 802.1 link aggregation. An example of a function that cause MLO to be something new is: BlockACK is being defined so that can work across multiple links and this does not work as aggregation.

C – These are independent mediums – I suggest BlockACKing across multiple links makes a lot of sense.

C – We are mixing implementation and function here. There may be a separate instance for each link, or a across multiple links. I view this as implementation and the architecture needs to be simple.

C – I want to keep it simple and just have a MAC and PHY.

C – please look at the 802.1 documents.

C – I think we can use slide 3 – it captures many of the things and could be extended for MLO

C – The 802.1 aggregation is at a high layer – let us not mix it with MLO. Let us stick to the Wi-Fi layer and not mix in other technologies and higher layers.

R – regarding Slide 3 some questions: How the data plane fits in the figure on slide 3? What does the AP look like when we connect the AP to the DS? How can a multi BSS AP deal with the connections to the DS? How the data plane work also needs to be clearly described. I will probably restructure this in the next iteration of this document.

C – Slide 3 labels what a STA is – but the STA is not labeled on slide 6. Maybe we should have two diagram – a data plane diagram and a management diagram.

C – Above the MAC SAP – I do not think MLO intends to do anything. I am in line with your thoughts on upper and lower. But I also see a single MAC.

*Additional discussion from the Webex Chat window during the above discussion:*

*C - I think I know what a "MAC" is as I think I understand 802.11 somewhat, please do not change that name.*

*C - We can even call them "MAC Sublayer I" and "MAC Sublayer II"*

*C - Then define their functionalities and add a note saying real implementation of any of these functions can be at any of the MAC sublayer I&II*

*C - agree with (above)*

*C - these are all .11 links; I am not sure why bluetooth etc. is being discussed.*

*C – agree with (above) - 11be is about aggregation within Wi-Fi.*

*C – agree with (above and above)*

*C - agree; but i also like the diagram in slide 6 and gives a better visual representations. perhaps some tweaks are needed for beacons/groupaddressed delivery etc.*

**Next Steps:**

The Chair proposed meeting on Alternate Mondays (when TGbe does not meet): 19:00-21:00 h ET.

**Adjourned – 21:01 h EDT.**

Note: final agenda slide deck is: [11-20/1343r5](https://mentor.ieee.org/802.11/dcn/20/11-20-1343-05-0arc-arc-sc-agenda-16-sep-2020.pptx)

**Attendance:**

| **Name** | **Affiliation** |
| --- | --- |
| Abouelseoud, Mohamed | Sony Corporation |
| Aboulmagd, Osama | Huawei Technologies Co. Ltd |
| Ansley, Carol | IEEE member / Self Employed |
| Asterjadhi, Alfred | Qualcomm Incorporated |
| Awater, Geert | Qualcomm Incorporated |
| Beg, Chris | Cognitive Systems Corp. |
| Berkema, Alan | HP Inc. |
| Berner, Stephan | PureLiFi |
| Bims, Harry | Bims Laboratories, Inc. |
| Bredewoud, Albert | Broadcom Corporation |
| Cheng, Paul | MediaTek Inc. |
| CHERIAN, GEORGE | Qualcomm Incorporated |
| Chitrakar, Rojan | Panasonic Asia Pacific Pte Ltd. |
| Chung, Chulho | SAMSUNG |
| DeLaOlivaDelgado, Antonio | InterDigital, Inc. |
| Derham, Thomas | Broadcom Corporation |
| Dogukan, Ali | Vestel |
| Dong, Xiandong | Xiaomi Inc. |
| Ecclesine, Peter | Cisco Systems, Inc. |
| ElSherif, Ahmed | Qualcomm Incorporated |
| Fang, Yonggang | ZTE TX Inc |
| Hamilton, Mark | Ruckus/CommScope |
| Hart, Brian | Cisco Systems, Inc. |
| Ho, Duncan | Qualcomm Incorporated |
| Hsiao, Ching-Wen | MediaTek Inc. |
| Hu, Chunyu | Facebook |
| Huang, Po-Kai | Intel Corporation |
| Inoue, Yasuhiko | Nippon Telegraph and Telephone Corporation (NTT) |
| Kedem, Oren | Huawei Technologies Co. Ltd |
| Kim, Youhan | Qualcomm Incorporated |
| Klimakov, Andrey | Huawei Technologies Co., Ltd |
| Kwon, Young Hoon | NXP Semiconductors |
| Lee, Il-Gu | Sungshin University |
| Lindskog, Erik | SAMSUNG |
| Malinen, Jouni | Qualcomm Incorporated |
| McCann, Stephen | Self |
| Naribole, Sharan | SAMSUNG |
| Patil, Abhishek | Qualcomm Incorporated |
| Patwardhan, Gaurav | Hewlett Packard Enterprise |
| Perkins, Richard | Qorvo |
| Pettersson, Charlie | Ericsson AB |
| Pushkarna, Rajat | Panasonic Asia Pacific Pte Ltd. |
| Qi, Emily | Intel Corporation |
| QIU, WEI | Huawei Technologies Co., Ltd |
| Rosdahl, Jon | Qualcomm Technologies, Inc. |
| Sand, Stephan | German Aerospace Center (DLR) |
| Sedin, Jonas | Ericsson AB |
| Serafimovski, Nikola | pureLiFi |
| Smely, Di Dieter | Kapsch TrafficCom AG |
| Smith, Graham | SR Technologies |
| Srinivasan, Shree Raman | Qualcomm Incorporated |
| Stacey, Robert | Intel Corporation |
| Sun, Bo | ZTE Corporation |
| Tian, Tao | Unisoc Comm. |
| Torab Jahromi, Payam | Facebook |
| Wang, Xiaofei | InterDigital, Inc. |
| Want, Roy | Google |
| Wentink, Menzo | Qualcomm Incorporated |
| Xin, Liangxiao | Sony Corporation |
| YANG, RUI | InterDigital, Inc. |
| yi, yongjiang | Futurewei Technologies |